REMARKS

Claims 1-29 are pending in the present application. Claims 1 and 13 were amended. Reconsideration of the claims is respectfully requested.

I. 35 U.S.C. § 103, Obviousness

The Examiner has rejected Claims 1, 13 and 23 under 35 U.S.C. § 103(a), as being unpatentable over U. S. Patent No. 5,535,067, to Rooke.

Claims 3-6, 11, 14-15, 19 and 24-25 apparently were also rejected under 35 U.S.C. § 103(a) as being unpatentable over U. S. Patent No. 5,535,067.

Claims 2, 7, 8, 12, 20-22 and 26-28 were rejected under U.S.C. § 103(a), as being unpatentable over Rooke in view of U. S. Patent No. 6,021,013, to Albrecht.

Claim 16 was rejected under 35 U.S.C. § 103(a), as being unpatentable over Rooke in view of U.S. Patent No. 6,389,090, to Zortea.

Claims 17 and 18 were rejected under 35 U.S.C. § 103(a), as being unpatentable over Rooke in view of U. S. Patent No. 6,775,084, to Contreras.

Claim 29 was rejected under 35 U.S.C. § 103(a), as being unpatentable over Rooke, in view of U.S. Patent No. 6,075,666, to Gillingham.

II. Purpose of Applicants' Invention

Applicants' invention generally pertains to an adaptive tape speed arrangement or system. In such arrangements the speed of moving data storage tape is varied, in order to match variations in the data exchange rate of an associated host system. Generally, arrangements of this type require a timing signal to coordinate the moving tape speed with the data exchange rate. However, prior art arrangements of the above type have been adversely affected by timing errors associated with the timing signal. Accordingly, Applicants' invention is provided, in order to overcome these deficiencies of the prior art. The above teachings of Applicants are set forth in the application, such as at page 2, line 6 through page 3, line 6:

> Adaptive tape speed systems attempt to remedy the situation by varying the tape speed to match the data rate to/from the host. U.S. Patent No. 5,892,633, to Ayres, et al., entitled "Dynamic Control of Magnetic Tape Drive," describes one such system, which relies on a buried (or embedded) servo pattern, normally used to align the read/write head with the tape, to determine the speed of the tape at a given moment and adjust the data rate of data being read or written to/from the tape to match the tape speed. U.S. Patent No. 6,122,124, to Fasen, et al., entitled "Servo System and Method with Digitally-Controlled Oscillator," also uses a servo pattern to measure the tape speed and adjust the data rate, except that a timing-based servo is used instead of a buried servo.

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Two problems exist with these servo based methods. The first is that if the read/write head is shifted off track center (which is a common occurrence), the timing signals experience phase variations, which affects the quality of the generated clock signal, and thus could cause timing errors. The second is that the low frequency nature of these servo signals requires large multiplication factors to achieve the clock frequencies of interest. This large multiplication factor also has the potential to cause phase variations affecting the quality of the generated clock signal. As the tape drive transfer rates increase, the problems become more acute. What is needed, then, is an adaptive media speed storage device that uses a modified pattern designed specifically for timing measurements.

III. Essential Features of Applicants' Invention

Applicants' Claim 1 currently reads as follows:

1. A method of establishing a data transfer rate between a moving storage medium and a read/write device, said method comprising the steps of:

reading successive reference regions on the moving storage medium to derive a timing signal having a frequency that varies directly with variations in the speed of the moving storage medium;

processing the timing signal to provide a clock signal having a frequency that is a function of the timing signal frequency, and thereby represents the speed of the storage medium; and

using the clock signal to determine the rate for writing data to the moving storage medium so that said rate is not dependent on any pre-specified value, and is proportional to the speed of the moving storage medium.

Essential features of Applicants' invention, as exemplified by Claim 1, are illustrated by **Figures 1** and **5** of the application, together with associated sections of the specification, such as at page 8, line 6 through page 9, line 7, page 12, lines 11-17 and page 13, lines 11-17. These excerpts of the application, which are set forth below, teach use of a read/write head **106** to read successive reference regions **308** on a moving storage medium, such as magnetic tape **108**, in order to derive a timing signal **116** having a frequency that varies directly with the speed of the moving storage medium. This is an essential feature of Applicants' invention, and is necessary to allow data to be written to the magnetic tape **108** at any speed that matches the tape speed, as taught by Applicants at page 8, lines 12-15. This essential feature, also recited as the reading step of Applicants' Claim 1, is further supported at page 12, lines 11-14.

Figure 5, together with teachings at page 13, lines 11-17, emphasizes that successive reference regions **308** must be read, in order to derive the required timing signal. **Figure 5** shows timing signal **116** comprising successive waveforms **312**, each resulting from a different successive reference region **308**. If only one reference region **308** of Applicants' disclosure was read, only one waveform **312** would be produced. In this event, there would be no timing signal **116**, having a frequency that varies directly with variations of storage medium speed.

The remaining steps of Claim 1 are taught in the application such as at page 9, lines 4-7. These steps include processing the timing signal **116** to provide a clock signal **120** that represents the speed of

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the storage medium, and using the clock signal to determine a rate for writing data to the moving storage medium that is proportional to the medium speed. Moreover, the data writing rate is derived so that it is not dependent on any pre-specified value, and can thus be easily adapted to varying storage medium speeds. **Figures** 6 and 7 of the application, together with page 13, lines 19-24 and page 15, lines 3-9 further support the processing step recited in Applicants' Claim 1. The application at page 15, lines 27-29 further supports the using step of Claim 1. These excerpts are also set forth hereinafter.

FIG. 1

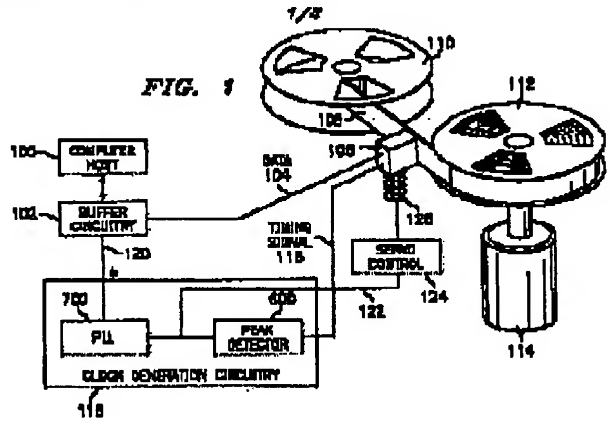
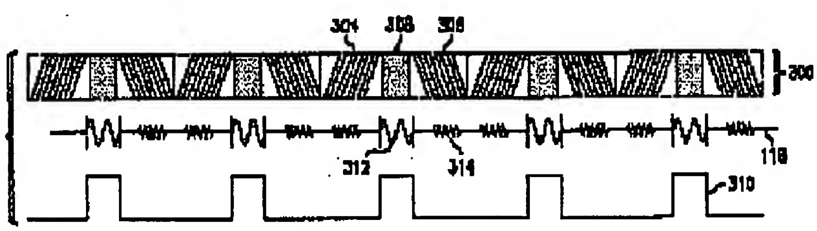


FIG. 5



Magnetic tape **108** moves from source spool **110** to take-up spool **112** in a pulley action from force applied by motor **114**. Source spool **110** and take-up spool **112** may exist separately, or may be incorporated into an integrated package, such as a tape cartridge or cassette. Motor 114 may operate at any of a continuous range of possible speeds. The present invention allows data to be written to magnetic tape 108 at a speed that matches the speed of motor 114. In this way, motor 114 can be sped up or slowed down as needed.

For example, if buffer circuitry **102** receives a large amount of data that must be written to magnetic tape **108**, motor **114** can be sped up to match the flow of data into buffer circuitry **102**. If the amount of data to be written is low, motor **114** can be slowed down. Conversely, computer host **100** is able to read a large amount of data at one time, motor **114** can be sped up to accommodate computer host **100**'s need for data. If computer host **100** cannot process a large

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amount of data at present, motor **114** can be slowed down to match the current capacity of computer host **100**.

As magnetic tape **108** moves in relation to read/write head assembly **106**, read/write head assembly 106 reads a timing signal 116 from reference regions written on magnetic tape 108. This timing signal will increase or decrease in frequency in direct relation to the change in tape speed. Clock generation circuitry **118** processes timing signal **116** to generate a clock signal **120** that may be used to time the reading and writing of data **104** by buffer circuitry. (Emphasis added) **(Page 8, line 6 through page 9, line 7)**

As the references regions pass by read/write head assembly 106 and are read, a timing signal (116 in Figure 1) is produced with a frequency that matches the frequency at which the reference regions are read. A vertical reference region, such as reference region **308** is preferable to diagonal regions **304** and **306** for generating a timing signal. (Emphasis added) **(Page 12, lines 11-17)**

Figure 5 is a diagram showing the relation between a servo track (**300**) containing reference regions (e.g., **308**), and the timing signal (**116**) and processed timing signal (**310**) derived therefrom. As each reference region (e.g., **308**) is read by read/write head assembly **106** (**Figure 1**), a corresponding waveform **312** is read from magnetic tape **108**. **(Page 13, lines 11-17)**

Peak detecting read channel **600**, shown in **Figure 6**, processes timing waveforms such as waveform **312** and produces processed timing signal **310**, which is used to enable the circuit illustrated in Figure 7. The result of **Figure 7** is a clock signal that is phase-locked to signal **312**. **(Page 13, lines 19-24)**

Figure 7 is a block diagram of a phase-locked loop (PLL) that may be utilized in a preferred embodiment of the present invention. The input to the phase locked loop is reference frequency **702**, which is fed into phase detector **704**. In a preferred embodiment, reference frequency **702** is the processed timing signal from output **616** of peak-detecting read channel **600** (**Figure 6**). **(Page 15, lines 3-9)**

Output **716** drives data transfer clock signal **120**, which is used by buffer circuitry **102** to time reading and writing operations.). **(Page 15, lines 27-29)**

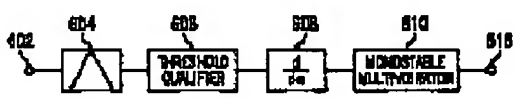

FIG. 6

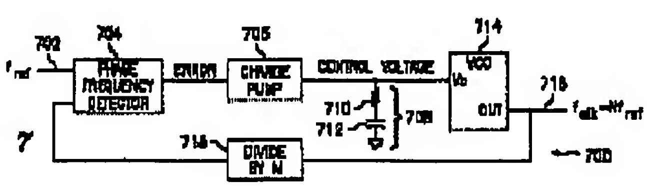

FIG. 7

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IV. Rejection of Claim 1

In the Office Action, the Examiner stated the following in rejecting Applicants' Claim 1 under 35 U.S.C. §103(a):

> Claims 1, 13, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rooke (US Patent No. 5, 535, 067).
>
> Regarding Claim 1, Rooke teaches a method of establishing a data transfer rate between a moving storage medium and a read/write device, said method comprising the steps of:
>
> > Reading successive reference regions on the moving storage medium to derive a timing signal having a frequency that varies directly with variations in the speed of the moving storage medium (Col. 3, L. 45-52);
> >
> > Processing the timing signal to provide a clock signal having a frequency that is a function of the timing signal frequency, and thereby represents the speed of the storage medium (Col. 3, L. 28-67 and Col. 4, L. 5-15);
> >
> > And using the clock signal to determine the rate for writing data to the moving storage medium, so that rate is proportional to the speed of the moving storage medium (Col. 3, L. 28-67 and Col. 4, L. 5-15). **[Office Action dated January 30, 2006, p. 2]**

V. Teachings of Rooke Reference

Figure 3 of Rooke shows a write clock generator provided with a counter 19 and a clock 10, comprising a variable frequency oscillator (VFO). The clock 10 produces an output clock signal 15, for use in writing data to a track of a rotatable data storage disk. The clock signal is also coupled to counter 19, which counts the number of clock pulses that occur during a period determined by reference clock signal 17. Signal 17 is proportional to the rotational speed of the disk, and has a frequency on the order of 1/20 the frequency of clock signal 15. The count value N_y, provided by counter 19 over one period of signal 17, is coupled to comparator 12 for comparison with an expected count value N_x. N_x corresponds to a desired bit spacing frequency, and thus represents a pre-specified preferred rate for writing data onto the storage disk.

The output of comparator 12, comprising the difference between N_x and N_y, is an error signal that is coupled to control logic 13. Control logic 13 responds to a non-zero error signal by producing a control signal 14, wherein the control signal adjusts clock 10 in an effort to make N_y equal to the desired count value N_x. N_y would be equal to N_x whenever data was being written to the disk at the desired rate or frequency. Thus, the clock generator shown by Fig. 3 of Rooke comprises a feedback loop that acts to increase or decrease the clock signal frequency, as determined by a pre-specified data writing rate represented by N_x.

The teachings discussed above are disclosed by Fig. 3 of Rooke and at col. 5, lines 6-40 thereof, set forth as follows:

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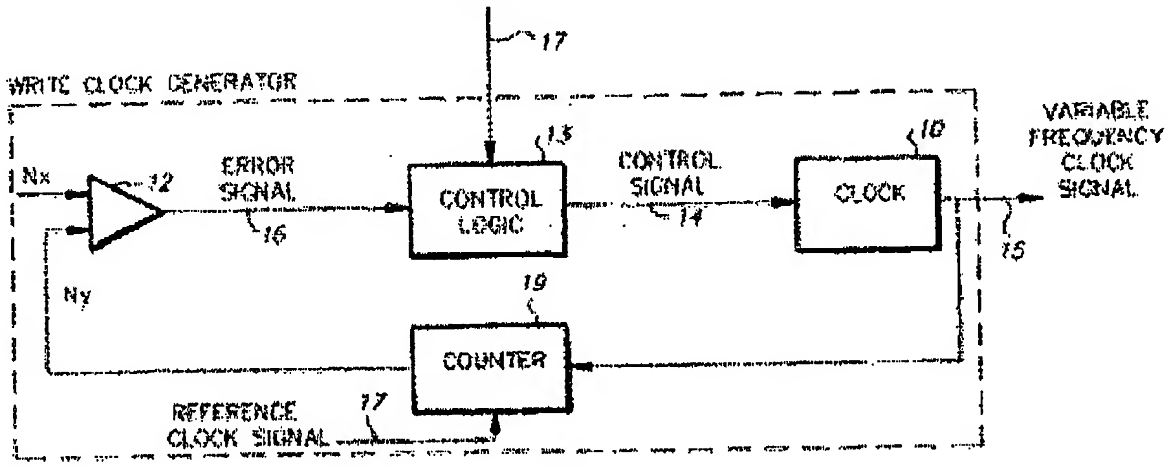

SYNCHRONOUS WRITE CLOCK GENERATOR

FIG. 3

The clock generator of the present invention is illustrated in the block diagram of FIG. 3. It comprises a variable frequency oscillator (VFO) 10, a counter 19, comparing means 12, and control logic 13. The VFO 10 receives a control signal 14, and generates a clock signal 15. The counter 19 is coupled to the clock signal 15 and an external reference clock signal 17, and generates a count value Ny. The comparing means 12 receives count value Ny and an expected count value Nx, and generates an error signal 16. The error signal 16 is received by the control logic 13, which also receives a reference clock signal 17 and generates a control signal 14.

During normal operation, the reference clock signal 17 has a nominal frequency generally less than 1/20 of the desired clock signal frequency and is proportional to the rotational speed of the spindle. Its actual frequency may vary somewhat with respect to this nominal frequency due to variations in the spindle speed. The VFO 10 provides clock signal 15 having a predetermined number of cycles for each period of the reference clock signal 17. The number of cycles generated will correspond approximately to the desired bit spacing frequency. For each reference period, the counter 19 initiates a sequence to count the number of clock cycles generated. The count value Ny obtained for each reference period is then provided to the comparing means 12. The comparing means 12 compares count value Ny to expected count value Nx. The expected count value Nx accurately corresponds to the desired bit spacing frequency. The comparing means 12 generates error signal 16 reflecting any difference between the compared values. The control means 13 transforms the error signal 16 into an appropriate control signal 14 supplied to the VFO 10. The control signal 14 causes the VFO 10 to increase or decrease the clock signal frequency. **[Col. 5, lines 6-40]**

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VI. Claim 1 Distinguishes Over Rooke Reference

Applicants consider that the Rooke reference neither discloses nor suggests the recitation of Claim 1. In particular, Rooke is considered to neither show nor suggest, in the over-all combination of Claim 1, either of the following features:

> (1) Using the clock signal to determine the rate for writing to the moving storage medium so that the rate is not dependent on any pre-specified value, and is proportional to the speed of the moving storage medium (hereinafter "Feature (1)")
>
> (2) Processing the timing signal to provide a clock signal having a frequency that is a function of the timing signal frequency (hereinafter "Feature (2)")

As emphasized above and taught in the application such as at page 8, lines 12-15, an important benefit of the present invention lies in allowing data to be written to a moving medium at a rate that matches the medium speed. This benefit is achieved, in significant part, through Feature (1) of Claim 1. In accordance with this feature, the clock signal is used to determine the rate for writing data to the moving storage medium so that the rate is not dependent on a pre-specified value. By avoiding any such pre-selected constraints in determining the rate for writing data, the clock signal of Applicants' Claim 1 is able to adapt the writing of data to match the speed of the storage medium, over a substantial speed range. In particular, the data writing rate can be made proportional to the storage medium speed.

As discussed above, Rooke teaches that N_x is a count value associated with a particular preferred rate or frequency for writing data to a disk. In the Rooke arrangement, N_x is absolutely essential for determining error signal. If N_x became unavailable, there would be no error signal calculation, and control signal 14 could not be provided to adjust clock 10. Thus, the absence of N_x would completely prevent operation of the write clock generator in Rooke. However, the Rooke arrangement cannot be modified to read on Applicants' Claim 1, unless the pre-specified value N_x is eliminated from such arrangement. Thus, an essential principle required by Rooke expressly teaches away from the recitation of Feature (1) of Applicants' Claim 1.

It is a well established principle of patent law that a reference cannot be modified, if a proposed modification would render the prior art reference being modified unsatisfactory for its intended purpose. **MPEP 2143.01.** Since modification of the Rooke clock generator to read on

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Feature (1) of Claim 1 would render the Rooke generator inoperable, it is very clear that Rooke neither discloses nor suggests such feature of Claim 1.

Claim 1 further distinguishes over Rooke in reciting Feature (2) thereof, directed to the step of processing the timing signal to provide a clock signal. The clock signal has a frequency that is a function of the timing signal frequency. Applicants' Claim 1 clearly teaches that the timing signal has "a frequency that varies directly with variations in the speed of the moving storage medium". Thus, to the extent there is any equivalency between Claim 1 and the Rooke disclosure, the reference clock signal 17 of Rooke must be the signal thereof that is equivalent to the timing signal of Claim 1. At column 5, lines 18-21, Rooke teaches that reference signal 17 has a frequency that is "proportional to the rotational speed of the spindle", and is thus proportional to the storage disk rotated thereby. Moreover, reference signal 17 is the only signal disclosed by Rooke as having "a frequency that varies directly with variations in the speed of the moving storage medium", the characteristic that defines the timing signal of Claim 1.

However, it is abundantly clear that the reference clock signal 17 of Rooke is not processed to provide a clock signal, as required by Feature (2) of Claim 1. In fact, the reference signal is not processed at all, for any purpose. Rooke teaches that reference signal 17 is merely used as a timing mechanism, to set successive counting periods for counter 19. This teaching is emphasized in Rooke, such as at column 5, lines 60-64 and by Figure 4. Reference signal 17 is also shown to be directed to control logic 13, but counter re-setting appears to be the only function for signal 17 that is taught by Rooke.

If clock signal 15 of Rooke is considered to be equivalent to the clock signal of Applicants' Claim 1, it is readily apparent that the clock signal 15 is not a function of reference signal 17. This is particularly indicated by Figure 4 of Rooke, which shows a number of processing tasks that follow the output of counter 19, in order to produce clock signal 15.

In view of the substantial differences discussed above, Applicants consider that teachings of Rooke would neither disclose nor suggest to those of skill in the art the recitation of Applicants' Feature (2), in the over-all combination of Claim 1.

VII. Claim 13 Distinguishes Over Rooke

Independent Claim 13 recites subject matter that is common to subject matter of Claim 1, and is considered to distinguish over the art including Rooke for the same reasons given in support for such common subject matter.

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VIII. Claims 2-12 Distinguish Over Cited References

Claims 2-12 respectively depend from Claim 1, and are each considered to patentably distinguish over the art for the same reasons given in support thereof.

Claim 2 is considered to further distinguish over the art, including the cited Rooke and Albrecht patents, particularly in reciting reference regions that extend in a second direction that is perpendicular to a first direction of storage medium movement, and in further reciting that respective reference regions are interleaved with timing-based servo regions that extend along diagonals with respect to the first and second directions. Albrecht, such as at col. 2, lines 55-67, teaches a track-following servo control system. The timing of pulses generated by the servo read head is decoded by appropriate circuitry to provide a speed invariant position signal used by the servo system to position the data heads over the desired data tracks on the storage media. Thus, Albrecht teaches away from the reference regions of Claim 2, which are provided to derive a timing signal that varies with storage medium speed variations, in accordance with Claim 1. The invention of Albrecht is only concerned with track patterns for use in positioning data heads. Albrecht, at col. 6, lines 48-50, explicitly states that Figs. 4, 5 and 6 thereof show alternative servo track patterns in accordance with its invention.

Claim 12 depends from Claim 2 as well as Claim 1, and is considered to patentably distinguish over the art for the same reasons given in support thereof. In addition, Claim 12 is considered to distinguish over the cited art in reciting reference regions that are interleaved with timing-based servo regions located on the moving storage medium, wherein the reference regions are adapted to provide information representing only the speed of the storage medium along the first direction, and the timing-based servo regions are adapted to provide information representing the position of the storage medium along a second direction perpendicular to the first direction. Neither Albrecht nor any other of the cited art shows or suggests any such features.

IX. Remaining Claims Distinguish Over Cited References

Claims 14-22 respectively depend from Claim 13, and are each considered to patentably distinguish over the art for the same reasons given in support thereof.

Claim 23 is considered to patentably distinguish over the prior art, particularly in reciting reference regions that are adapted to provide information representing only the speed of the

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recording surface along a first direction, and timing-based servo regions that are adapted to provide information representing the position of the recording surface along a second direction perpendicular to the first direction. Such recitation is considered to distinguish over the art for reasons set forth above in regard to Claims 2 and 12.

Claims 24-29 respectively depend from Claim 23, and are each considered to patentably distinguish over the art for the same reasons given in support thereof.

X. Conclusion

It is respectfully urged that the subject application is patentable over the Rooke, Albrecht, Landman, Zortea, Contreras and Gilllingham references, and over any combination thereof, and is now in condition for allowance.

The Examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

DATE: April 19, 2006

Respectfully submitted,

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